

CLAIMS

1. A tire building drum comprising: a pair of bead lock means adapted to be displaced toward and away from each other and thereby expanded or contracted; carcass band folding-back means, positioned
5 adjacent to the bead lock means, respectively; and a center shaft for supporting these means;

wherein said tire building drum further comprises at least one core body at an axial inside of said bead lock means, said core body comprising a plurality of sheets of rigid support members toroidally
10 disposed and adapted to be displaced and thereby expanded or contracted.

2. The tire building drum of claim 1, further comprising: a center bladder deformable for expansion or contraction, which extends at a radial outside of said core body, and which has both axial side
15 portions adapted to be displaced toward and away from each other integrally with said bead lock means, respectively;

wherein said rigid support members are provided with comb tooth portions, respectively, for engagement of said rigid support members with each other.

20 3. The tire building drum according to claim 1 or 2, wherein said bead lock means each comprise: bead lock segments circumferentially arranged adjacent to each other so as to be expanded or contracted in an annular shape; associated links having one ends hinged to said bead lock segments, respectively; bead lock pistons
25 coupled to other ends of said links, respectively, and provided in an axially displaceable manner; and bead lock cylinders adapted to displace the associated bead lock pistons, respectively.

4. The tire building drum according to claim 3, further comprising: means for varying an axial position of that bead lock
30 means relative to an axial side portion of said center bladder, which is located at the same axial side as the axial side portion of the center bladder.

5. The tire building drum according to any one of claims 1

through 4, wherein said carcass band folding-back means are adapted to be displaced toward and away from each other, integrally with said bead lock means at the axially same sides as said carcass band folding-back means, respectively; and

5 wherein each of said carcass band folding-back means includes: a plurality of folding-back arms arranged in a circumferential direction and having tip end portions at axial insides, respectively; neck-turning members hinged to the tip end portions of said folding-back arms, respectively, so as to be swung to radial inside and outside; folding-back
10 back rollers circumferentially extending and born by longitudinal opposite end portions of the associated neck-turning members, respectively; a slide ring hinged to proximal ends of said plurality of folding-back arms and adapted to be displaceable to axial inside and outside relative to the associated bead lock means; and urging means
15 for exerting a swinging force directed toward a radial inside, onto said folding-back arms.

6. The tire building drum according to claim 5, wherein each of a pair of said folding-back rollers born by the associated neck-turning member is divided into two portions at both sides of an associated
20 portion of said neck-turning member for supporting the folding-back roller, and is circumferentially protruded from the associated neck-turning member, so that protruded directions of said pair of folding-back rollers are opposite to each other, and so that a roller rotational shaft supporting portion corresponding to one of said pair of folding-back
25 rollers has a circumferentially extended area positioned within a circumferentially extended area of the other folding-back roller.

7. The tire building drum according to claim 5 or 6, wherein each of said folding-back rollers is provided with roller rotational speed restricting means for restricting a roller rotational speed
30 correspondingly to this speed.

8. The tire building drum according to any one of claims 1 through 7, wherein said core body is provided by one in number and arranged in-between said pair of bead lock means; and

wherein said tire building drum further comprises: a pair of sleeves adapted to be displaced toward and away from each other on said center shaft; sleeve reciprocative driving means for displacing said sleeves; and link mechanisms having one ends coupled to said rigid support members, respectively, and the other ends coupled to said pair of sleeves, respectively, said link mechanisms being each adapted with a pair of links having intermediate portions hinged to each other, respectively.

9. The tire building drum according to claim 8, wherein said sleeve reciprocative driving means is adapted with: screw portions formed at end portions of said sleeves, respectively, and having mutually opposite lead orientations for the right and left sleeves, respectively; screw blocks threadedly engaged with said screw portions, respectively; and rotating means for relatively rotating said sleeves and the associated screw blocks, respectively;

wherein said tire building drum further comprises: sliders having mounted thereon said bead lock means, respectively, and adapted to displace said bead lock means toward and away from each other; and bead lock reciprocative driving means for displacing said pair of bead lock means; and

wherein said bead lock reciprocative driving means is adapted with: female screw members coupled to radial insides of said sliders, respectively; a screw shaft disposed in a hollow of said center shaft and having right and left male screw portions threadedly engaged with the associated female screw members, respectively; and screw shaft rotating means for rotating the screw shaft; in which said right and left male screw portions of said screw shaft have mutually opposite lead orientations, respectively.

10. The tire building drum according to claim 8, further comprising: means for restraining rotation of said screw blocks; and means for rotating, together with said sleeves, said center shaft fitted through said sleeves by circumferential convex and concave.

11. The tire building drum according to claim 9, further

comprising: means for rotating both said screw blocks synchronizedly with each other; and means for fitting said sleeves onto said center shaft by circumferential convex and concave.

12. The tire building drum according to claim 10 or 11, further
5 comprising: means for restricting rotation of said screw blocks relative to said center shaft.

13. The tire building drum according to claim 8, wherein said sleeve reciprocative driving means is adapted with: female screw members coupled to said sleeves at radial insides thereof, respectively;
10 a screw shaft disposed in a hollow of said center shaft and having right and left male screw portions threadedly engaged with the associated female screw members, respectively; and screw shaft rotating means for rotating the screw shaft; in which the right and left male screw portions of said screw shaft have mutually opposite lead orientations,
15 respectively;

wherein said tire building drum further comprises: sliders having mounted thereon said bead lock means, respectively, and adapted to displace said bead lock means toward and away from each other; and bead lock reciprocative driving means for displacing said pair of bead
20 lock means; and

wherein said bead lock reciprocative driving means is adapted with: screw portions formed at end portions of said sliders, respectively, so as to have mutually opposite screw thread extending directions for the right and left sliders, respectively; screw blocks
25 threadedly engaged with said screw portions, respectively; and rotating means for rotating said sliders and said screw blocks relative to each other.

14. The tire building drum according to claim 13, further comprising: means for restraining rotation of said screw blocks; and
30 means for rotating, together with said sliders, said center shaft fitted through said sliders by circumferential convex and concave.

15. The tire building drum according to claim 13, further comprising: means for rotating both said screw blocks synchronizedly

with each other; and means for fitting said sliders onto said center shaft by circumferential convex and concave.

16. The tire building drum according to claim 14 or 15, further comprising: means for restricting rotation of said screw blocks relative
5 to said center shaft.

17. The tire building drum according to any one of claims 1 through 7, wherein said core bodies are provided by two in number, and said core bodies are arranged near axial insides of said pair of bead lock means, respectively;

10 wherein said tire building drum further comprises: a pair of sliders having mounted thereon said core bodies and said bead lock means located at the axially same sides as said sliders, respectively; slider reciprocative driving means for displacing said sliders, respectively; and core-body expanding/contracting means for
15 expanding or contracting said core bodies, respectively; and

wherein each of said core-body expanding/contracting means is adapted with: expanding/contracting link parts coupled to said rigid support members constituting the associated core body, respectively; a screw block restrained in axial displacement and adapted to be
20 rotatable relative to said center shaft; a longitudinal movement screw member threadedly engaged with said screw block so as to be restrained in rotation about said center shaft, and adapted to be axially displaceable; and a link uniting part for coupling said
expanding/contracting link parts to said longitudinal movement screw
25 member.

18. The tire building drum according to claim 17, wherein said slider reciprocative driving means are adapted with: female screw members coupled to said sliders at radial insides thereof, respectively; a screw shaft disposed in a hollow of said center shaft and having right
30 and left male screw portions threadedly engaged with said female screw members, respectively; and screw shaft rotating means for rotating said screw shaft; in which said right and left male screw portions of said screw shaft have mutually opposite leads, respectively.

19. The tire building drum according to claim 17 or 18, further comprising: means for restraining rotation of said screw blocks; and means for rotating, together with said sliders, said center shaft fitted through said sliders by circumferential convex and concave.

5 20. The tire building drum according to claim 17 or 18, further comprising: means for rotating both said right and left screw blocks synchronizably with each other; and means for fitting said sliders onto said center shaft by circumferential convex and concave.

21. The tire building drum according to claim 19 or 20, further
10 comprising: means for restricting rotation of said screw blocks relative to said center shaft.

22. A tire building method using the tire building drum according to any one of claims 1 through 21, comprising steps of:

locking bead cores by said bead lock means, respectively;

15 then bulging a center portion of a carcass band while displacing said bead lock means close to each other;

folding back side portions of the carcass band to radial outsides around the bead cores, respectively;

thereafter radially expanding said core body to a maximum
20 diameter, while locking the bead cores; and

assembling tire component members onto the radially expanded core body.

23. A tire building method using the tire building drum according to any one of claims 5 through 21, comprising a step of:

25 moving said folding-back arms of said folding-back means to axial insides synchronizably with each other, respectively, to synchronizably swing to radial outsides said folding-back arms around proximal ends thereof against swinging forces by said urging means while causing said folding-back rollers to be rolledly contacted
30 with carcass band side portions, respectively, to thereby fold back the carcass band around the bead cores.

24. The tire building method according to claim 23, wherein said folding-back arms are synchronizably swung to radial outsides,

respectively, such that side portions of the carcass band to be folded back by said folding-back means are rolledly pressure-jointed to a carcass band center portion by any one of said folding-back rollers at any point of the side portions of the carcass band.

5 25. A tire building method using the tire building drum according to any one of claims 8 through 16, comprising a step of: radially expanding said core body to a position where at least side surfaces of said core body are opposed to the bead cores, respectively, and then folding back the carcass band side portions around the bead
10 cores, respectively.

26. The tire building method according to claim 25, further comprising a step of: radially expanding said core body to a position where side surfaces of said core body are opposed to the bead cores, respectively, and thereafter displacing said bead lock means to an
15 axial center to bring said bead lock means close to core body side surfaces, respectively, thereby starting folding back of the carcass band side portions.

27. The tire building method according to claim 26, further comprising a step of: folding back the carcass band side portions by
20 said folding-back rollers while urging the carcass band side portions toward the carcass band center portion supported by core body side portions.

28. The tire building method according to any one of claims 25 through 27, further comprising a step, after folding back the carcass
25 band side portions around the bead cores, respectively, of: pressure-jointing folded back end portions by stitching rollers each subjected to a knurling treatment.

29. The tire building method according to any one of claims 25 through 28, further comprising a step of: gradually reducing a pressure
30 within said center bladder, as an interior of said center bladder is pressurized to bulge a center portion of the carcass band and as the core body is radially expanded to a maximum diameter.

30. The tire building method according to any one of claims 25

through 29, further comprising steps of:

detecting a load of a motor for driving said sleeve reciprocative driving means upon radially expanding said core body; and

controlling at least one of an internal pressure of the center
5 bladder, and a spacing between said pair of bead lock means, based on a value of the load.